DRAFT BIOLOGICAL ASSESSMENT

COLLIER COUNTY
COMPREHENSIVE WATERSHED IMPROVEMENT PLAN
COLLIER COUNTY, FLORIDA

APPENDIX L: FLORIDA PANTHER IMPACT ASSESSMENT

Collier County Comprehensive Watershed Improvement Project (CWIP)
Project Effects: Florida Panther (*Puma concolor cougar)* Habitat

Overview and Project Description

The Collier County Comprehensive Watershed Improvement Project (CWIP) proposes changes to hydrology in habitat for the Florida Panther (*Puma concolor coryi*), a state and federally endangered species. The 9,000-acre primary hydration area and project assessment area (22,000 acres between I-75 – US-41) are defined as primary panther habitat. See **Appendix F: Vegetation Hydrology Effects Analysis** for details on the project's effect on hydrology within the different vegetation communities. Lands in the primary and dispersal zones are of the highest importance in a landscape context to the Florida panther (USFWS 2012). In order to assess effects of the project on panther habitat, we propose the use of the US Fish and Wildlife Service (USFWS) methodology developed in 2006 and updated in 2012 (USFWS 2012). This methodology has also been attached at the end of this document as **Sub-Appendix 1**.

To evaluate project effects to the Florida panther, the USFWS method considers the contributions the project lands provide to the Florida panther, recognizing not all habitats provide the same functional value (USFWS 2012). As a result, the USFWS developed cost surface values for various habitat types, based on use by and presence in home ranges of panthers. The FWC, using a similar concept, assigned likely use values of habitats to dispersing panthers. The FWC's habitats were assigned habitat suitability ranks between 0 and 10, with higher values indicating higher likely use by dispersing panthers. The updated methodology has combined these values in order to consolidate the different habitat ranks (**Table 1**). This project will use current FLUCCS (Florida Land Use Classification Code System) data as the basis for habitat analysis and use the USFWS 2012 methodology as the guide for the calculations. NOTE: The land cover types described in the USFWS methodology are not classified using FLUCCS. See the *Panther Habitat Type* columns within **Table 2** & **Table 3** for details on what land cover types were assigned to the different FLUCCS communities present within the construction footprints.

<u>Project Description</u>

Water will be diverted from the Golden Gate Canal through pumps located upstream of the GG-3 weir. Based on a GG-3 flow duration analysis and permitted water diversions from the canal, the project proposes to divert 100 CFS when the discharge through the structure exceeds 450 CFS (~ 55 days/year) and 50 CFS when the discharge is between 200 CFS and 450 CFS (~ 83 days/year). Diversions will occur most often during the wet season however; sufficient water is expected to be available during early dry season to allow for smaller (i.e. 50 CFS) diversions. The diverted water will flow southwards via a proposed ditch that discharges water directly into the I-75 north canal. An operable gate structure is proposed on the I-75 north canal to force water to move eastwards and hence restrict discharge into Henderson Creek. The water will continue to flow south into the I-75 south canal through existing culverts under I-75, where it will be pumped into a proposed flowway located south of the canal, which will serve as an in-line water treatment facility providing settlement of solids to treat runoff from I-75. The spreader swale will have fixed weirs controlling water elevations in the entire flowway system as well as releasing water into Belle Meade Forest as sheet flow. Once released into the forest, the flow of water is driven by forest topography which slopes gradually from northeast to southwest. After infiltration and evapotranspiration losses, the remaining water will reach the southwest end where a collector ditch will receive the majority of the water near the eastern edge of Naples Reserve subdivision. The flow will be routed around the residential developments by means of proposed canals and will be discharged into U.S. 41 canal. A small portion of the forest water will continue to flow southwest as gravity sheet flow under Winding Cypress Drive. The

water will continue to flow south under Tamiami Trail through existing culverts. The water will be routed through the Fiddlers Creek residential developments using two existing canals both of which discharge into a linear lake bordering the southern boundary of Fiddler's Creek. The water will spill over the southern bank of the lake into wetlands fringing Rookery Bay as sheet flow. The sheet flow will continue to flow south and southwest towards Rookery Bay. A small fraction of the flow will make its way westwards under existing S.R. 951 culverts. The reader is referred to **Supplemental Information Attachment 5: Hydrologic and Hydraulic Modeling**, section 2.2.1.2, provided as part of the USACE permit application, for details of the project drainage system and design details.

The project infrastructure will impact about 36 acres of wetlands and alter a total of about 60 acres of natural habitat. The habitat improvements over more than 9,000 acres provided by the rehydration will also provide the mitigation necessary to offset wetland impacts.

Methodology

Vegetation cover types and land uses were classified using the Florida Land Use and Cover Classification System (FLUCCS). The database used for the project and for the Panther Habitat Unit (PHU) calculations combined the most recent FNAI mapping of the Picayune Strand State Forest (which covers a large portion of the project area) with the most recent (2016) SFWMD FLUCCS mapping to create a seamless FLUCCS shapefile. Information regarding the creation of this shapefile and the overall composition of the vegetation communities can be found within **Appendix F: Vegetation Hydrology Effects Analysis**.

<u>Habitat assessment methodology application</u>

The project includes several sites accounting for 60.47 acres of impact. The development includes three pump stations, access roads, a spreader ditch to distribute water across a wide front in the Picayune Strand State Forest Cypress-dominated habitat, and berms, ditches, and other features to protect private outparcels and development existing at the edges of the project area. The wetlands and uplands in the construction footprints will be cleared and variously converted to uplands (pump stations, berms, etc.) or open water (channels / ditches). All berms will be completely grassed. No impervious surface is planned for access roads to the pump stations and other features that may need maintenance access. However, there will be some impervious surfaces associated with the concrete weirs found within the spreader swale and pump stations. Per the USFWS methodology, in rural settings berms may provide species benefit and should be classified as the habitat they will most resemble in the post-project condition (USFWS 2012). For this project, as the berms will be grassed, they will be evaluated as pasture.

The location of a project in the landscape of the core area of the Florida panther is important. The project area, within the primary panther habitat zone, includes only the most minimal development (drivable dirt tracks within the forest and a few outparcels) with no potential for future development within the larger project area, as it is part of the state forest. As recommended by USFWS, we have assumed a landscape base ratio of 1.98 as described in the 2012 assessment methodology.

Much of the natural habitat in the project impact areas are infested with exotic plant species, which affects the functional value the habitat type provides to foraging wildlife. Per the habitat assessment methodology, there is a habitat type and functional value for exotic species (USFWS 2012). Per the methodology, this category includes not only the total acres of pure exotic species habitats present but also the percent-value acreages of the exotic species present in other habitat types, as present throughout the project construction footprints.

To calculate the PHUs needed for mitigation, the existing and proposed panther habitat units were calculated for each of the project construction footprints using the habitat unit values described in **Table 1**. To calculate the existing PHUs, the following calculations were performed for each habitat type and summed to obtain a value of 354.52 PHUs (**Table 2**).

Equation 1

$$Total\ Acreage \times Percent\ 'Not - Exotic' \times Habitat\ Suitability\ Value$$

Equation 2

$$Total\ Acreage \times Percent\ 'Exotic' \times Exotic\ Habitat\ Suitability\ Value\ (= 3)$$

As the proposed berms will be entirely grassed, and per the panther methodology attached to this document, habitat values associated with pasture were assigned to those areas that will be converted to berm. As such, the panther habitat units associated with the proposed project were calculated as above to obtain a value of 142.94 PHUs (**Table 3**).

This results in a net loss of 211.58 PHUs within the project impact areas. This value of 211.58 PHUs was then multiplied by the 1.98 (the base ratio multiplier) resulting in a value of 418.93 PHUs for the project impact areas needed for mitigation (**Table 4**).

The base ratio is further described in the USFWS methodology (**Sub-Appendix 2**). Note: While the USFWS methodology document has a final base ratio multiplier of 2.5, Constance Cassler, USFWS recommended use of a base ratio value of 1.98 rather than 2.5 to remove the general traffic and development portions of the base ratio calculation (Personal Communication – Email Jan. 2020). See **Sub-Appendix 2** for figures depicting existing and proposed PHUs associated with each project impact area.

References

USFWS 2012 – United States Fish and Wildlife Service (USFWS), 2012. *Panther Habitat Assessment Methodology.* United States Fish & Wildlife Service, South Florida Ecological Services Office, Vero Beach, FL. Obtained November 2019 at: https://www.fws.gov/verobeach/MammalsPDFs/20120924_Panther%20Habitat%20Assessment%20Method_Appendix.pdf

Table 1. 2009 Habitat Unit Values for Use in Assessing Habitat Value to The Florida Panther (USFWS 2012).

Land Cover Type	Value	Land Cover Type	Value	Land Cover Type	Value
Reservoirs	*	Xeric scrub	4.5	Dry prairie	6.3
STAs	**	Orchards/groves	4.7	Upland Hardwood Forest	9.0
Urban	0	Marsh/ wet prairie	4.7	Cypress swamp	9.2
Water	0	Cropland	4.8	Hardwood swamp	9.2
Barren/Disturbed lands	3	Improved pasture	5.2	Hardwood-Pine	9.3
Coastal wetlands	3	Shrub swamp/brush	5.5	Upland-Hydric Pine forest	9.5
Exotic/nuisance plants	3	Unimproved pasture	5.7		

* PHU values for reservoirs are evaluated based on open water for the main water areas and the appropriate categories for berms and other non-water sections.

** PHU values for stormwater treatment areas vary depending on design criteria, mode of operation, location in native or non-native habitats, and other landscape features.

Table 2. Existing Panther Habitat Units

Location	FLUCCS	Total Acreage	Exotic Percent	Non-Exotic				Exotic				TOTAL IMPACT
				Acreage	Panther Habitat Type	Panther Habitat Value	Panther Habitat Unit	Acreage	Panther Habitat Type	Panther Habitat Value	Panther Habitat Unit	
North Belle Meade Flowway	411/Pine Flatwoods/E2: 25-50%	0.98	0.25	0.735	Upland-Hydric Pine Forest	9.5	6.99	0.25	Exotic/Nuisance Plants	3	0.74	
North Belle Meade Flowway	411/Pine Flatwoods/E3: 50-75%	0.04	0.5	0.021	Upland-Hydric Pine Forest	9.5	0.20	0.02	Exotic/Nuisance Plants	3	0.06	
North Belle Meade Flowway	411/Pine Flatwoods/E4: >75%	3.00	0.75	0.750	Upland-Hydric Pine Forest	9.5	7.12	2.25	Exotic/Nuisance Plants	3	6.75	
North Belle Meade Flowway	415/Mixed Pine/E3: 50-75%	0.74	0.5	0.368	Hardwood-Pine	9.3	3.43	0.37	Exotic/Nuisance Plants	3	1.11	
North Belle Meade Flowway	415/Mixed Pine/E4: >75%	0.52	0.75	0.130	Hardwood-Pine	9.3	1.21	0.39	Exotic/Nuisance Plants	3	1.17	
North Belle Meade Flowway	624/Cypress - Pine - Cabbage Palm/E3: 50-75%	5.75	0.5	2.874	Cypress Swamp	9.2	26.44	2.87	Exotic/Nuisance Plants	3	8.62	
North Belle Meade Flowway	8146/Primitive Trails/-	0.08	0	0.080	Barren/Disturbed Lands	3	0.24	0.00	Exotic/Nuisance Plants	3	0.00	
	TOTAL	***11.11***				***TOTAL***	***45.63***			***TOTAL***	***18.45***	***64.08***
South Belle Meade Flowway	411/Pine Flatwoods/E1: <25%	8.10	0	8.104	Upland-Hydric Pine Forest	9.5	76.99	0.00	Exotic/Nuisance Plants	3	0.00	
South Belle Meade Flowway	411/Pine Flatwoods/E2: 25-50%	0.43	0.25	0.320	Upland-Hydric Pine Forest	9.2	2.95	0.11	Exotic/Nuisance Plants	3	0.32	
South Belle Meade Flowway	624/Cypress - Pine - Cabbage Palm/E1: <25%	10.94	0	10.939	Cypress Swamp	9.2	100.64	0.00	Exotic/Nuisance Plants	3	0.00	
South Belle Meade Flowway	624/Cypress - Pine - Cabbage Palm/E2: 25-50%	4.58	0.25	3.439	Cypress Swamp	9.2	31.64	1.15	Exotic/Nuisance Plants	3	3.44	
South Belle Meade Flowway	624/Cypress - Pine - Cabbage Palm/E3: 50-75%	0.95	0.5	0.477	Cypress Swamp	9.2	4.38	0.48	Exotic/Nuisance Plants	3	1.43	
South Belle Meade Flowway	8146/Primitive Trails/-	4.58	0	4.579	Barren/Disturbed Lands	3	13.74	0.00	Exotic/Nuisance Plants	3	0.00	
	TOTAL	***29.59***				***TOTAL***	***230.33***			***TOTAL***	***5.19***	***235.52***
Southern Flowway 1	510/Streams and Waterways/-	2.89	0	2.891	Water	0	0.00	0.00	Exotic/Nuisance Plants	3	0.00	
Southern Flowway 1	624/Cypress - Pine - Cabbage Palm/E2: 25-50%	1.88	0.25	1.411	Cypress Swamp	9.2	12.99	0.47	Exotic/Nuisance Plants	3	1.41	
Southern Flowway 1	740/Disturbed Land/-	0.08	0	0.085	Barren/Disturbed Lands	3	0.25	0.00	Exotic/Nuisance Plants	3	0.00	
Southern Flowway 1	743/Berm/-	0.25	0	0.247	Improved Pasture	5.2	1.29	0.00	Exotic/Nuisance Plants	3	0.00	
	TOTAL	***5.10***				***TOTAL***	***14.52***			***TOTAL***	***1.41***	***15.94***
Southern Flowway 2	510/Streams and Waterways/-	4.32	0	4.324	Water	0	0.00	0.00	Exotic/Nuisance Plants	3	0.00	
Southern Flowway 2	743/Berm/-	0.47	0	0.467	Improved Pasture	5.2	2.43	0.00	Exotic/Nuisance Plants	3	0.00	
	TOTAL	***4.79***				***TOTAL***	***2.43***			***TOTAL***	***0.00***	***2.43***
Southern Flowway 3	814/Roadway/-	4.05	0	4.045	Barren/Disturbed Lands	3	12.14	0.00	Exotic/Nuisance Plants	3	0.00	
	TOTAL	***4.05***				***TOTAL***	***12.14***			***TOTAL***	***0.00***	***12.14***
Southern Flowway 4	510/Streams and Waterways/-	0.34	0	0.337	Water	0	0.00	0.00	Exotic/Nuisance Plants	3	0.00	
Southern Flowway 4	621/Cypress/E1: <25%	0.34	0	0.340	Cypress Swamp	9.2	3.13	0.00	Exotic/Nuisance Plants	3	0.00	
Southern Flowway 4	624/Cypress - Pine - Cabbage Palm/E1: <25%	0.45	0	0.452	Cypress Swamp	9.2	4.16	0.00	Exotic/Nuisance Plants	3	0.00	
Southern Flowway 4	8146/Primitive Trails/-	0.46	0	0.463	Barren/Disturbed Lands	3	1.39	0.00	Exotic/Nuisance Plants	3	0.00	
	TOTAL	***1.59***				***TOTAL***	***8.68***			***TOTAL***	***0.00***	***8.68***
Pedestrian Path	8146/Primitive Trails	0.40	0	0.401	Barren/Disturbed Lands	3	1.20	0.00	Exotic/Nuisance Plants	3	0.00	
	TOTAL	***0.40***				***TOTAL***	***1.20***			***TOTAL***	***0.00***	***1.20***
Sanders Blvd Property	500/Water/-	0.04	0	0.043	Water	0	0.00	0.00	Exotic/Nuisance Plants	3	0.00	
Sanders Blvd Property	619/Exotic Wetland Hardwoods/-	0.51	1	0.000	-	-	-	0.51	Exotic/Nuisance Plants	3	1.53	
Sanders Blvd Property	624/Cypress - Pine - Cabbage Palm/E4: >75%	1.07	0.75	0.268	Cypress Swamp	9.2	2.46	0.80	Exotic/Nuisance Plants	3	2.41	
Sanders Blvd Property	625/Wet Pinelands Hydric Pine/E4: >75%	0.92	0.75	0.229	Upland-Hydric Pine Forest	9.5	2.17	0.69	Exotic/Nuisance Plants	3	2.06	
Sanders Blvd Property	740/Disturbed Land/-	1.27	0	1.271	Barren/Disturbed Lands	3	3.81	0.00	Exotic/Nuisance Plants	3	0.00	
Sanders Blvd Property	814/Roads and Highways/-	0.03	0	0.026	Barren/Disturbed Lands	3	0.08	0.00	Exotic/Nuisance Plants	3	0.00	
	TOTAL	***3.84***				***TOTAL***	***8.53***			***TOTAL***	***6.00***	***14.53***
	TOTAL ACRES ALL AREAS	***60.47***									***GRAND TOTAL PHU***	***354.52***

PHU = panther habitat units

Table 3. Proposed Panther Habitat Units

Location	FLUCCS	Acreage	Panther Habitat Type	Panther Habitat Value	Panther Habitat Unit
North Belle Meade Flowway	211/Improved Pastures	6.97	Improved Pastures	5.2	36.25
North Belle Meade Flowway	512/Channelized Waterways, Canals	4.07	Water	0	0.00
North Belle Meade Flowway	8335/Pumping Stations	0.07	Urban	0	0.00
	TOTAL	***11.11***		***TOTAL***	***36.25***
South Belle Meade Flowway	211/Improved Pastures	14.83	Improved Pastures	5.2	77.09
South Belle Meade Flowway	512/Channelized Waterways, Canals	13.68	Water	0	0.00
South Belle Meade Flowway	740/Disturbed Land	0.17	Barren/Disturbed Lands	3	0.50
South Belle Meade Flowway	747/Dikes and Levees	0.83	Barren/Disturbed Lands	3	2.48
South Belle Meade Flowway	8335/Pumping Stations	0.09	Urban	0	0.00
	TOTAL	***29.59***		***TOTAL***	***80.07***
Southern Flowway 1	211/Improved Pastures	0.70	Improved Pastures	5.2	3.62
Southern Flowway 1	512/Channelized Waterways, Canals	4.41	Water	0	0.00
	TOTAL	***5.10***		***TOTAL***	***3.62***
Southern Flowway 2	211/Improved Pastures	1.37	Improved Pastures	5.2	7.12
Southern Flowway 2	512/Channelized Waterways, Canals	3.42	Water	0	0.00
	TOTAL	***4.79***		***TOTAL***	***7.12***
Southern Flowway 3	211/Improved Pastures	0.07	Improved Pastures	5.2	0.34
Southern Flowway 3	512/Channelized Waterways, Canals	3.98	Water	0	0.00
	TOTAL	***4.05***		***TOTAL***	***0.34***
Southern Flowway 4	211/Improved Pastures	0.40	Improved Pastures	5.2	2.07
Southern Flowway 4	512/Channelized Waterways, Canals	0.71	Water	0	0.00
Southern Flowway 4	8146/Primitive Trails	0.48	Barren/Disturbed Lands	3	1.45
	TOTAL	***1.59***		***TOTAL***	***3.52***
Pedestrian Path	8146/Primitive Trails	0.40	Barren/Disturbed Lands	3	1.20
	TOTAL	***0.40***		***TOTAL***	***1.20***
Sanders Blvd Property	211/Improved Pastures	2.08	Improved Pastures	5.2	10.82
Sanders Blvd Property	512/Channelized Waterways, Canals	1.65	Water	0	0.00
Sanders Blvd Property	8335/Pumping Stations	0.10	Urban	0	0.00
	TOTAL	***3.84***		***TOTAL***	***10.82***
	TOTAL ACRES ALL AREAS	***60.47***		***GRAND TOTAL PHU***	***142.94***
PHU = Panther Habitat Units					

Table 4. Results of Florida Panther Habitat Assessment for the Project Impact Areas

Impact and Mitigation PHU Calculations	
Existing PHUs	354.52
Proposed PHUs	142.94
Net PHUs	211.58
Base Ratio	1.98
Mitigation PHUs	**418.93**
PHU = Panther Habitat Units	

SUB-APPENDIX 1: USFWS PANTHER HABITAT ASSESSMENT METHODOLOGY (2012)

Panther Habitat Assessment Methodology **September 24, 2012**

The Service developed the panther habitat assessment methodology in 2006 and updated the methodology in 2009. To evaluate project effects to the Florida panther, the Service considers the contributions the project lands provide to the Florida panther, recognizing not all habitats provide the same functional value. Kautz et al. (2006) also recognized not all habitats provide the same habitat value to the Florida panther and developed cost surface values for various habitat types, based on use by and presence in home ranges of panthers. The FWC (2006), using a similar concept, assigned likely use values of habitats to dispersing panthers. The FWC's habitats were assigned habitat suitability ranks between 0 and 10, with higher values indicating higher likely use by dispersing panthers.

The Service chose to evaluate project effects to the Florida panther through a similar process. We incorporated many of the same habitat types referenced in Kautz et al. (2006) and FWC (2006) with several adjustments to the assigned habitat use values reflecting consolidation of similar types of habitats and the inclusion of Comprehensive Everglades Restoration Plan (CERP) water treatment and retention areas. We used these values (Tables PM1 and PM2) as the basis for habitat evaluations and the recommended compensation values to minimize project effects to the Florida panther, as discussed below.

Base ratio: To develop a base ratio that will provide for the protection of sufficient acreage of primary zone equivalent lands for a population of 90 panthers (31,923 acres per panther [Kautz et al. (2006)]) from the acreage of primary zone equivalent non-urban lands at risk, we developed the following approach.

The available primary zone equivalent lands at the time the methodology was developed (2006) were estimated at 3,276,563 acres (ac) (see Tables PM3 and PM4), with 2,073,865 ac of primary zone equivalent, non-urban lands preserved. The remaining non-urban, at-risk, private lands were estimated at 1,202,698 ac of primary zone equivalent lands. To meet the protected and managed lands threshold for a population of 90 panthers, an additional 799,205 ac of primary zone equivalent lands are needed. The base ratio is determined by dividing the primary equivalents of at-risk habitat to be secured (799,205 ac) by the result of the acres of at-risk habitat in the primary zone (610,935 ac) times the value of the primary zone (1); plus the at-risk acres in the dispersal zone (27,883 ac) times the value of the dispersal zone (1); plus the at-risk acres in the secondary zone (503,481 ac) times the value of the secondary zone (0.69); plus the at-risk acres in the other zone (655,996 ac) times the value of the other zone (0.33); minus the at-risk ac of habitat to be protected (799,205 ac). The results of this formula provide a base value of 1.98.

$$799{,}205 / ([(610{,}935 \times 1.0) + (27{,}883 \times 1) + (503{,}481 \times 0.69) + (655{,}996 \times 0.33)] - 799{,}205) = 1.98$$

In evaluating habitat losses in the consultation area, we used an estimate of 0.8 percent loss of habitat per year (Kautz, personal communication, 2004) to predict the amount of habitat loss anticipated in south Florida during the next 5 years (*i.e.*, 6,000 hectares/year [14,820 ac/ year]). We conservatively assume that we would be aware of half of the development projects that occur within the primary zone and the secondary zone combined. We further assume that 50 percent of these projects would be located in the primary zone and 50 percent would be located in the secondary zone. Based on these assumptions, we estimated that over a 5-year period about 37,000 ac (primary zone

equivalent of 31,265 ac) would be developed without Federal review. To reflect this loss of habitat we adjusted the base acreage density of 31,923 acres per panther (Kautz et al. [2006]) to a new base density of 32,275 ac per panther, an increase of 352 acres (31,265/90=352+31,923=32,275). This adjustment results in a base ratio change from 1.98 to 2.23.

The Service realizes habitat losses from individual single-family residential developments will collectively compromise the Service's landscape scale effort to secure sufficient lands for a population of 90 panthers. We believe that, on an individual basis, single-family residential developments by individual lot owners on lots no larger than 5.0 ac will not result in take of panthers on a lot-by-lot basis; however, collectively these losses may affect the panther. Panthers are a wide-ranging species, and individually a 5.0-acre habitat change will not have a measurable impact. Compensation for such small-scale losses on a lot-by-lot basis is unlikely to result in meaningful conservation benefits for the panther versus the more holistic landscape level conservation strategy used in our habitat assessment methodology. To account for these losses, based on the 0.08 percent annual loss referenced by Kautz (2004), we estimated the development of vacant lands (2003) in northern Golden Gate Estates and Lehigh Acres in Collier and Lee counties, respectively, at about 2,590 ac per year per development, or about 12,950 ac per development over a 5-year period. As above, to reflect this loss we adjusted the revised base acreage density to 32,563 ac, an increase of 288 acres (25,900/90=288+352+31,923=32,563). To account for this loss, we further adjusted the base value from 2.23 to 2.48.

There is also a need for road crossings in strategic locations and we believe there are projects that may not have habitat loss factors but will have traffic generation factors. The Service considers increases in traffic as an indirect effect from a project, which can contribute to panther mortality. For assessment purposes, since our habitat methodology does not provide a mechanism to address this type of effect directly, we are providing a habitat surrogate of 500 ac per year of habitat loss for these types of projects, with a not to exceed value of 2,500 ac over the 5-year period. The 500 ac per year is based on average cost of FDOT bridge/box culvert crossings (3.6 to 5 million dollars) converted to acreage equivalent costs (8,500/ac). This 2,500 acre habitat surrogate adds an additional 28 acres per panther to the above adjusted base for a new base of 32,951 ac per panther (2,500/90=28+288+352+31,923=32,591). Therefore, we have added another 0.02 to the base ratio to address traffic impacts, which could provide an incentive to implement crossings in key locations. Following the same approach shown above, we adjusted the base ratio from 2.48 to 2.5. The Service intends to re-evaluate this base ratio periodically and adjust as needed to make sure all adverse effects are adequately ameliorated and offset as required under section 7 of the act and to achieve the Service's landscape scale effort for the Florida panther.

The Service uses a very conservative density of panthers per area of habitat to calculate the compensation ratio for impacts south of the Caloosahatchee River. Specifically, the Service relied on the low estimate in the range presented in Kautz et al. (2006) to reach its factor of 2.5. This low estimate density value was calculated by dividing the documented number of panthers in 2000, or 62 panthers, by an estimate of the habitat in the primary zone that was most consistently occupied by panthers from 1981 to 2000. As previously mentioned, it is clear the

panther population south of the river has increased notably since 2000, in 2001 = 78 panthers; in 2002 = 80; in 2003 = 87; in 2004 = 78; in 2005 = 82; in 2006 = 97; in 2007 = 117; and 2008=104. In 2007 more panthers were documented in south Florida than have been documented since current verified estimates have been collected. Furthermore, none of the panthers recorded south of the Caloosahatchee River lives exclusively outside of the primary zone, although some do venture outside of it on occasion (McBride, personal communication, 2007).

The average population size south of the Caloosahatchee River over the past 7 years is 86. If we were to use this number instead of 62 to calculate the compensation ratio and to use the entire acreage of the primary zone as the denominator, the revised compensation ratio requirement would be 0.32 ac protected for every acre developed. Furthermore, if we excluded the "other zone" altogether from the analysis, the ratio would be 1.01, still lower than the Service's current ratio. We believe this conservative approach is warranted because of the inherent importance of habitat protection to panther conservation.

Landscape multiplier: As stated in the above section on primary zone equivalent lands, the location of a project in the landscape of the core area of the Florida panther is important. As we have previously discussed, lands in the primary and dispersal zones are of the highest importance in a landscape context to the Florida panther, with lands in the secondary zone of less importance, and lands in the other zone of lower importance. These zones affect the level of compensation the Service believes is necessary to minimize a project's effects to Florida panther habitat. Table PM5 provides the landscape compensation multipliers for various compensation scenarios. As an example, if a project is in the other zone and compensation is proposed in the primary zone, a primary zone equivalent multiplier of 0.33 is applied to the PHUs (see discussion below) developed for the project. If the project is in the secondary zone and compensation is in the primary zone, then a primary zone equivalent multiplier of 0.69 is applied to the PHUs developed for the project.

Panther Habitat Units – habitat functional value: Prior to applying the base ratio and landscape multipliers discussed above, we evaluate the project site and assign functional values to the habitats present. This is done by assigning each habitat type on-site a habitat suitability value from the habitats shown in Tables PM1 and PM2. The habitat suitability value for each habitat type is then multiplied by the acreage of that habitat type resulting in a number representing PHUs. These PHUs are summed for a site total, which is used as a measurement of the functional value the habitat provides to the Florida panthers. This process is also followed for the compensation sites.

As of January 2005, the Service has been using a panther habitat suitability ranking system based in part on methods in publications by Swanson et al. (2005) and Kautz et al. (2006) and adjusted by the Service to consolidate similar types of habitats and to include CERP water treatment and retention areas located in the panther's range (Table PM1). Since the implementation of this ranking system, the Service has received two additional, published habitat assessment studies (Cox et al. [2006] and Land et al. [2008]) that further assess habitat usage by the Florida panther. As it is the Service's policy to incorporate the most current peer-reviewed science into our assessment

and review of project effects on the Florida panther, we have revised the current habitat suitability ranking system.

To revise these values, the Service, in coordination with FWC, examined the habitat ranking values in the two new papers referenced above and Kautz et al. (2006) publication and developed a spreadsheet. The spreadsheet was developed to: (1) compare the results of each of these published analyses; and (2) provide a habitat ranking system for each of the assessments. On the first page of the spreadsheet, labeled "panther habitat selection analysis - habitat papers comparison," we summarized the types of analyses performed as to whether it was second order (selection of a home range with a large study area) or third order (selection of habitats within a home range). For each of these analyses, we then listed the habitat types reported in each paper and their order of selection by panthers (Table PM6). We used the cost surface scores and the rank differences from the Kautz et al. (2006) analyses as the selection order and for a measure of statistical differences among the habitat types. Selected habitat types are represented as bold black numbers and avoided habitats are bold red numbers. Habitats that were neither selected nor avoided are shown as normal font black numbers. Ranks with the same letter are not different from each other. Results from the Cox et al. (2006) and Land et al. (2008) papers using Euclidean analyses are shown in a similar fashion.

On the second page of the spreadsheet, labeled "summary of ranking values," we ranked the habitat types on a scale from 0 to 10 according the results from each study and professional judgment (Table PM7). We used our original ranking for the Kautz et al. analyses (with the ranking scale reversed such that the best habitat received a "10" and the lowest quality habitat was "0").

We developed similar rankings for the habitat analyses reported in Cox et al. (2006) and Land et al. (2008). Selected habitats fell in the range of 7 to 10; habitats that were used in proportion to availability were ranked from 4 to 6; and habitats that were avoided by panthers were ranked from 0 to 3. Ranks for habitats within each of the 3 outcomes began at the top of each of the ranges (selected = 10, used in proportion to availability = 6, avoided = 3). Some shifting of the ranks occurred based on the letter-coded statistical ranking. For instance, under *Land GPS Euclidean third order* both upland and wetland forests were selected by panthers and were not statistically different from each other (note the ranking of a and ab for upland and wetland forest, respectively). However, wetland forest and dry prairie also were not significantly different from each other. To show these relationships, we ranked upland forest as a 10, wetland forest as a 9, and we increased dry prairie from a 6 (top of the neither selected nor avoided ranking) to a 7 to reflect the interplay between dry prairie and wetland forest based on professional judgment.

To generate a new ranking of panther habitats for use as a habitat assessment measure, we simply averaged the ranks of the six different analyses presented in the spreadsheet to the first decimal place. Half of these results were second order habitat analyses (Kautz et al. compositional, Kautz et al. Euclidean and Cox et al. Euclidean) and the other half were third order analyses (Cox et al. Euclidean; Land et al. VHF Euclidean; Land et al. GPS Euclidean).

In our assessment, we noted several outlier habitat rankings that, based on our understanding of habitat needs of the Florida panther and our concern for human/panther interactions, appear to provide conflicting values. These habitats and their associated rankings are: (1) barren/disturbed – 5.2; (2) urban – 5.0; (3) open water – 3.3; and (4) coastal wetlands – 1.0. We believe adjustments are warranted for these four categories and our adjusted values are based on the following:

Barren/disturbed: Barren/disturbed lands may include many temporary changes to land use, such as crop rotation and prescribed fires that likely have little impact on the value to panthers. Areas disturbed by human impact on a longer-term basis (*e.g.*, parking of equipment and material storage areas) have chronic effects on panthers that we judge decrease the value of these lands for panthers. Barren/disturbed lands include disturbed lands (Florida land use and cover classification system [FLUCCS] 740) and spoil areas (FLUCCS 733). Based on the above reasons, we assigned barren/disturbed land a value of 3.

Urban: Panther habitat models typically include urban in the "other" category that was neither avoided nor selected by panthers. Highly urbanized areas are not found in the panther core area that was used in assessing habitat use, as panthers have already selected against these land use types by reducing their range. However, urbanizing areas in more rural settings may appear in the assessment of habitat use. Nevertheless, we believe that potential human/panther interactions are important conflict factors to consider as well. Therefore, we assigned both developed rural and highly urbanized areas a value of 0.

Open water: Open water has been found to be either avoided by panthers or included in the "other" category that was neither avoided nor selected by panthers. We believe open water in any setting provides little to no value to panthers. However, open water edges and berms can be a valuable foraging area or dispersal pathway in more rural settings, although these edges in an urbanized setting could promote human/panther conflicts. Therefore, we assigned open water in an urban setting, with or without emergent vegetation, and surrounding berms a value of 0. However, in rural settings, the littoral edges and berms may provide species benefit and are further addressed under the reservoir discussion below.

Coastal wetlands: There are few strictly coastal wetlands, such as salt marshes and mangrove swamps, within the panther focus area. Where these occur, they are closely interspersed with other upland habitats. In this context, we believe that these areas are of greater value to the panther than the models indicate. These areas may, for the most part, be avoided by panthers; but, they can be of value in the proper landscape context to higher value habitats. Therefore we assigned these areas a value of 3.

We also note that three additional land uses and or habitat types referenced in our original habitat rankings were not components addressed directly in the model. These include: (1) exotic/ nuisance plants; (2) stormwater treatment areas (STAs); and (3) reservoirs. We believe these categories are important in our assessment of panther habitat values and warrant consideration in our habitat ranking system.

Exotic/nuisance plants: Although exotic plants can be suitable for providing denning cover and habitat connectivity between other land types for panthers and panther prey, they generally do not provide the preferred foraging base of plants consumed by deer and other herbivores (Fleming et al. 1994). We believe prey foraging value, or lack thereof, is an important constraint in our habitat assessments. Therefore, we assigned these habitats a value of 3. Likewise, some native plant species can become so dominant and dense, especially under altered hydrologic and fire suppression regimes, that they no longer provide high habitat value for the panther even though occasional use may occur. The most common example is dense, nearly monotypic cattail stands, which are of reduced value relative to less altered marsh communities. Another example of this type of nuisance species dominance is dense stands of cabbage palm dominated communities. For systems represented by this habitat profile, we also assigned a value of 3.

STAs (Everglades restoration): STAs are generally designed to provide a water quality treatment function for nutrient removal from received upstream discharges and may include multiple berms and adjacent littoral shelves. Depending on the design and mode of operation, they can become vegetated by dense monotypic stands of cattails or can incorporate a diverse mosaic of wetland communities and hydroperiods that support sawgrass and shrub/scrub species. Therefore, they can provide various levels of resource benefit to panthers and panther prey species as discussed below. For this reason, the final value of an STA is determined in a case-by-case basis during project review.

The Service participates in planning efforts that encourage location of STAs at sites with minimal areas of natural habitat, with a preference for sites that are currently in agriculture. Because these facilities by design are located in areas that currently provide a reduced value to panthers and panther prey species, the Service values these systems pre and post project development as a neutral effect on panthers. In these situations, the development of an STA from existing agriculture land uses would be evaluated as if the agriculture land use was present following project development, with no increase or decrease in habitat value to the panther.

However, this neutral effect assessment is only applicable to land conversions from nonnative habitats to STAs. For those projects that remove natural habitats, the Service considers STA functional values to mimic the value of the natural system the STA is designed to achieve. As an example, an STA design that results in a dense monotypic stand of cattails would be appropriately evaluated following the exotic/nuisance species profile. Similarly, a system designed to provide a diverse mosaic of wetland communities and hydroperiods would be evaluated following the wet prairie/marsh profile. Another system design that incorporates internal and external berms could include an edge benefit evaluation identifying the berms and adjacent littoral shelves and their benefit to the Florida panther and panther prey species, and follow the values provided for improved pasture for the berms and or wet prairie/marsh values for the littoral shelves. An individual project assessment of pre and post habitat impacts will identify whether the project as designed results in loss of functional value or provides benefit to the Florida panther and panther prey species.

Reservoirs (Everglades restoration, large water storage area, mines): Reservoirs were originally classified as their own category in our 2003 assessment method. They differ from open-water systems primarily with their location in the landscape. In urban areas, reservoirs have always been considered open water and given a value of 0. In rural areas, the open water portion of the reservoir provides no habitat value, although the edges and the berms can provide valuable foraging area or dispersal pathways for the panther and panther prey species. Therefore, the 2003 methodology assigned a value of 1.5 to reservoirs to attempt to account for these benefits.

After further consideration, we believe a more appropriate way to evaluate the value of reservoirs is to evaluate the open water component separately from the reservoir edges and berms. Therefore, we are no longer assigning a value to reservoirs as their own habitat classification. When large-scale reservoir projects are proposed in the rural landscape, all open water areas should be classified as such (value = 0). Berms and edges should be classified as the habitat they will most resemble in the post-project condition. For example: a 1,000-acre reservoir with 50 ac of grassed berms and 50 ac of berms with roads along the top would be evaluated as 900 ac of open water, 50 ac of pasture, and 50 ac of urban.

We also recognized the habitat matrix (Table PM7) lists four native habitats similar in functional habitat value to panthers as non-native habitats: marsh/wet prairie – 4.7; xeric scrub – 4.5; shrub and brush – 5.5; and dry prairie – 6.3. These habitat ratings, which are between 4 and 6, are classified as being neither selected nor avoided by panthers. The Service's Florida Panther Recovery Plan's (Service 2008) action 1.1.1.2.3 recommends habitat preservation and restoration within the primary zone be provided in situations where land use intensification cannot be avoided. We view this recommendation as a key parameter in our conservation goal to locate, preserve, and restore lands containing sufficient area and appropriate land cover types to ensure the long-term survival of a population of Florida panthers south of the Caloosahatchee River.

Therefore, for assessment purposes, if a project is proposing restoration of non-native habitats (*e.g.*, pasture, row crops, groves, etc.) to native habitats, we believe that a restoration lift to a value of 7 is appropriate. The functional value of 7 corresponds to that value found in the literature where panthers begin to select for that habitat attribute (Table PM7). We also believe a full functional lift credit for these restorations is appropriate as the time lag from restoration to full functional value is estimated to be relatively short (less than 5 years) for non-forested systems. However, the calculation of forested restoration values remains the same as in the previous methodology, which is one-half the difference between pre- and post-restoration.

In summary, we believe appropriate adjustments to our original PHU values are warranted based on the most current peer-reviewed science and our category specific discussions above. Therefore, we have incorporated the above referenced values into our revised habitat assessment matrix and these values are the current basis for habitat evaluations and the recommended compensation values to minimize project effects to the Florida panther (Table PM2).

Exotic species assessment: since many habitat types in south Florida are infested with exotic plant species, which affects the functional value a habitat type provides to foraging wildlife

species (*i.e.*, primarily deer and hog), we believe the presence of these species and the value these species provide to foraging wildlife needs to be considered in the habitat assessment methodology. As shown in Table PM2, we have a habitat type and functional value shown for exotic species. This category includes not only the total acres of pure exotic species habitats present but also the percent-value acreages of the exotic species present in other habitat types.

For example, a site with 100 ac of pine flatwoods with 10 percent exotics would be treated in our habitat assessment methodology as 90 ac of pine flatwoods and 10 ac of exotics. Adding another 100 ac of cypress swamp with 10 percent exotics would change our site from 90 ac of pine flatwoods and 10 ac of exotics to 90 ac of pine flatwoods, 90 ac of cypress swamp, and 20 ac of exotics.

Habitat assessment methodology application – example: To illustrate the use of our habitat assessment methodology, we provide the following example. A 100-acre project site is proposed for a residential development. Plans call for the entire site to be cleared. The project site contains 90 ac of hydric pine flatwoods and 10 ac of exotic vegetation, and is located in the "secondary zone." The applicant has offered habitat compensation in the "primary zone" to minimize the impacts of the project to the Florida panther. To calculate the PHUs provided by the site, we multiply the habitat acreage by the "habitat suitability value" for each habitat type and add those values to obtain a value of 885 PHUs ((90 ac of pine flatwoods x 9.5 [the habitat suitability value for pine flatwoods] = 855 PHUs) + (10 ac of exotic vegetation x 3 [the habitat suitability value for exotics] = 30 PHUs) = 885 PHUs). The value of 885 PHUs is then multiplied by the 2.5 (the base ratio) and 0.69 (the landscape multiplier) resulting in a value of 1,527 PHUs for the project site. In this example, the acquisition of lands in the primary zone containing at least 1,527 PHUs is recommended to compensate for the loss of habitat to the Florida panther resulting from this project.

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Table PM1. Original panther habitat unit values for use in assessing habitat value to the Florida panther.

Land Cover Type	Value	Land Cover Type	Value	Land Cover Type	Value
Water	0	STA	4.5	Cypress swamp	9
Urban	0	Shrub swamp	5	Sand pine scrub	9
Coastal strand	1	Shrub and brush	5	Sandhill	9
Reservoir	1.5	Dry prairie	6	Hardwood-Pine forest	9
Mangrove swamp	2	Grassland/pasture	7	Pine forest	9
Salt marsh	2	Freshwater marsh	9	Xeric oak scrub	10
Exotic/nuisance plants	3	Bottomland hardwood	9	Hardwood forest	10
Cropland	4	Bay swamp	9		
Orchards/groves	4	Hardwood swamp	9		

Table PM2. Revised panther habitat unit values for use in assessing habitat value to the Florida panther.

Land Cover Type	Value	Land Cover Type	Value	Land Cover Type	Value
Reservoirs	*	Xeric scrub	4.5	Dry prairie	6.3
STAs	**	Orchards/groves	4.7	Upland Hardwood Forest	9.0
Urban	0	Marsh/ wet prairie	4.7	Cypress swamp	9.2
Water	0	Cropland	4.8	Hardwood swamp	9.2
Barren/Disturbed lands	3	Improved pasture	5.2	Hardwood-Pine	9.3
Coastal wetlands	3	Shrub swamp/brush	5.5	Upland-Hydric Pine forest	9.5
Exotic/nuisance plants	3	Unimproved pasture	5.7		

* PHU values for reservoirs are evaluated based on open water for the main water areas and the appropriate categories for berms and other non-water sections. Refer to pages 5- 7 for the accompanying text for guiding criteria for these systems.

** PHU values for stormwater treatment areas vary depending on design criteria, mode of operation, location in native or non-native habitats, and other landscape features. Refer to page 6 for the accompanying text for guiding criteria for these systems.

Table PM3. Land Held for Conservation within the Florida Panther Core Area.

	Acres	Primary Equivalent Factor	Primary Equivalent Acres
Primary	1,659,657	1.00	1,659,657
Dispersal	0	1.00	0
Secondary	308,623	0.69	212,950
Other	609,872	0.33	201,258
TOTAL	2,578,152	TOTAL	2,073,865

Table PM4. Undeveloped Privately Owned Land within Florida Panther Core Area.

	Acres	Primary Equivalent Factor	Primary Equivalent Acres
Primary	610,935	1.00	610,935
Dispersal	27,883	1.00	27,883
Secondary	503,481	0.69	347,402
Other	655,996*	0.33	216,479
TOTAL	1,962,294	TOTAL	1,202,699

* About 819,995 ac are at-risk in the other zone with about 80 percent with resource value. Total ac of at-risk privately owned lands are 1,962,294 ac.

Table PM5. Landscape Compensation Multipliers.

Zone of Impacted Lands	Zone of Compensation Lands	Multiplier
Primary	Secondary	1.45
Secondary	Primary	0.69
Other	Secondary	0.48
Other	Primary	0.33

Table PM6. Panther Habitat Selection Analyses – Habitat Papers Comparison.

Habitats	Kautz compositional second order	rank	Kautz Euclidean second order	rank	Habitats	Cox Euclidean second order	rank	Cox Euclidean third order	rank	Habitats	Land VHF Euclidean third order	rank	Land GPS Euclidean third order	rank
Hardwood swamp	**1**	A	**3**	A	Coniferous forest	**1**	A	**1**	A	Upland forest	**1**	A	**1**	A
Pineland	**2**	A	**2**	AB	pineland					pine/hardwood				
Cypress swamp	3	AB	**1**	BC	Hardwood forest	**3**	C	**2**	A	hardwood hammock				
Upland forest	**1**	B	**4**	CD	hardwood hammock					pinelands				
Dry prairie	5	B	5	DE	mixed pine/hardwood					tropical hammock				
Shrub and brush	4	C	7	EF	palm/oak					palm/hardwood				
Xeric scrub	3	CD	**9**	F	tropical hammock					Wetland forest	**2**	A	**2**	AB
Marsh	5	CD	**9**	F	Forested wetland	**2**	B	**3**	A	cypress swamp				
Unimproved pasture	**7**	DE	7	G	cypress swamp					cypress/pine/palm				
Barren	6	E	**9**	G	mixed forest					mixed swamp				
Improved pasture	**9**	EF	6	G	shrub swamp					hardwood swamp				
Urban	8	F	8	G	hardwood swamp					Dry prairie/grass	3	B	3	BC
Cropland	**9**	F	8	H	other wet forest					grassland				
Citrus	**10**	G	8	H	Dry prairie/grass	**4**	C	4	B	unimproved pasture				
Coastal wetlands	**11**	G	8	H	dry prairie					improved pasture				
Open water	**10**	H	**10**	I	grassland					Marsh/shrub	6	B	4	C
Exotic plants					Open wetland	7	E	**7**	C	marsh/wet prairie				
STA					marsh and wet prairie					sawgrass				
Reservoir					sawgrass					cattail				
					cattail					shrub swamp				
					Agricultural	**5**	D	5	B	Other	4	B	5	C
second order - selection of home range with entire study area					improved pasture					open water				
third order - selection of habitats within home range					citrus					shrub/brush				
Bold (black) - habitat used more than availability (selection)					row crop					barren				
Bold (red) - habitat used less than availability (avoidance)					other agriculture					high impact urban				
rank - habitats with same letters did not differ in preference					Urban/barren	**6**	E	6	B	low impact urban				
					bare soil					extractive				
					high-impact urban					Agriculture	5	B	6	C
					low-impact urban					citrus				
					extractive					row crop				
										other agriculture				

Table PM7. Summary of Ranking Values

Habitats	Kautz compositional second order	Kautz Euclidean second order	Cox Euclidean second order	Cox Euclidean third order	Land VHF Euclidean third order	Land GPS Euclidean third order	Average
Hardwood swamp	10	7	9	10	10	9	9.2
Pineland	9	8	10	10	10	10	9.5
Cypress swamp	8	9	9	10	10	9	9.2
Upland forest	10	6	8	10	10	10	9.0
Dry prairie	6	5	8	6	6	7	6.3
Shrub and brush	7	3	no data	no data	6	6	5.5
Xeric scrub	8	1	no data	no data	no data	no data	4.5
Marsh	6	1	6	3	6	6	4.7
Unimproved pasture	4	3	8	6	6	7	5.7
Barren	5	1	7	6	6	6	5.2
Improved pasture	2	4	7	6	6	6	5.2
Urban	3	2	7	6	6	6	5.0
Cropland	2	2	7	6	6	6	4.8
Citrus	1	2	7	6	6	6	4.7
Coastal wetlands	0	2	no data	no data	no data	no data	1.0
Open water	1	0	no data	no data	6	6	3.3
Exotic plants							
STA							
Reservoir							

habitat selection	7,8,9,10
neither selected nor avoided	4,5,6
habitat avoidance	0,1,2,3

SUB-APPENDIX 2: PANTHER HABITAT ASSESSMENT FIGURES

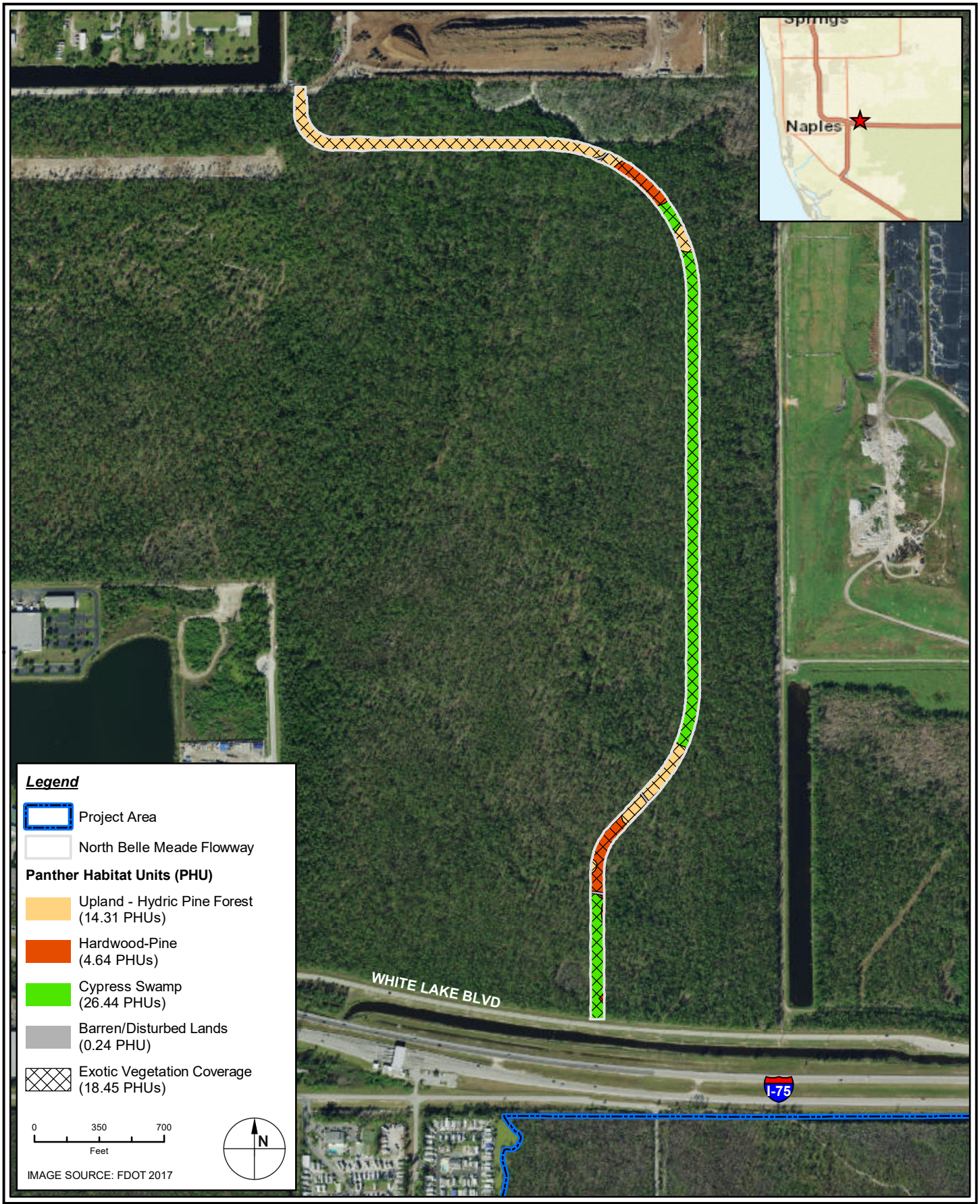

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FIGURE 1
NORTH BELLE MEADE FLOWWAY
EXISTING PANTHER HABITAT UNITS
PANTHER ANALYSIS
COLLIER COUNTY, FLORIDA

PROJECT	C2018-052
DRAWN BY	KM
SHEET	
DATE	JAN 2020

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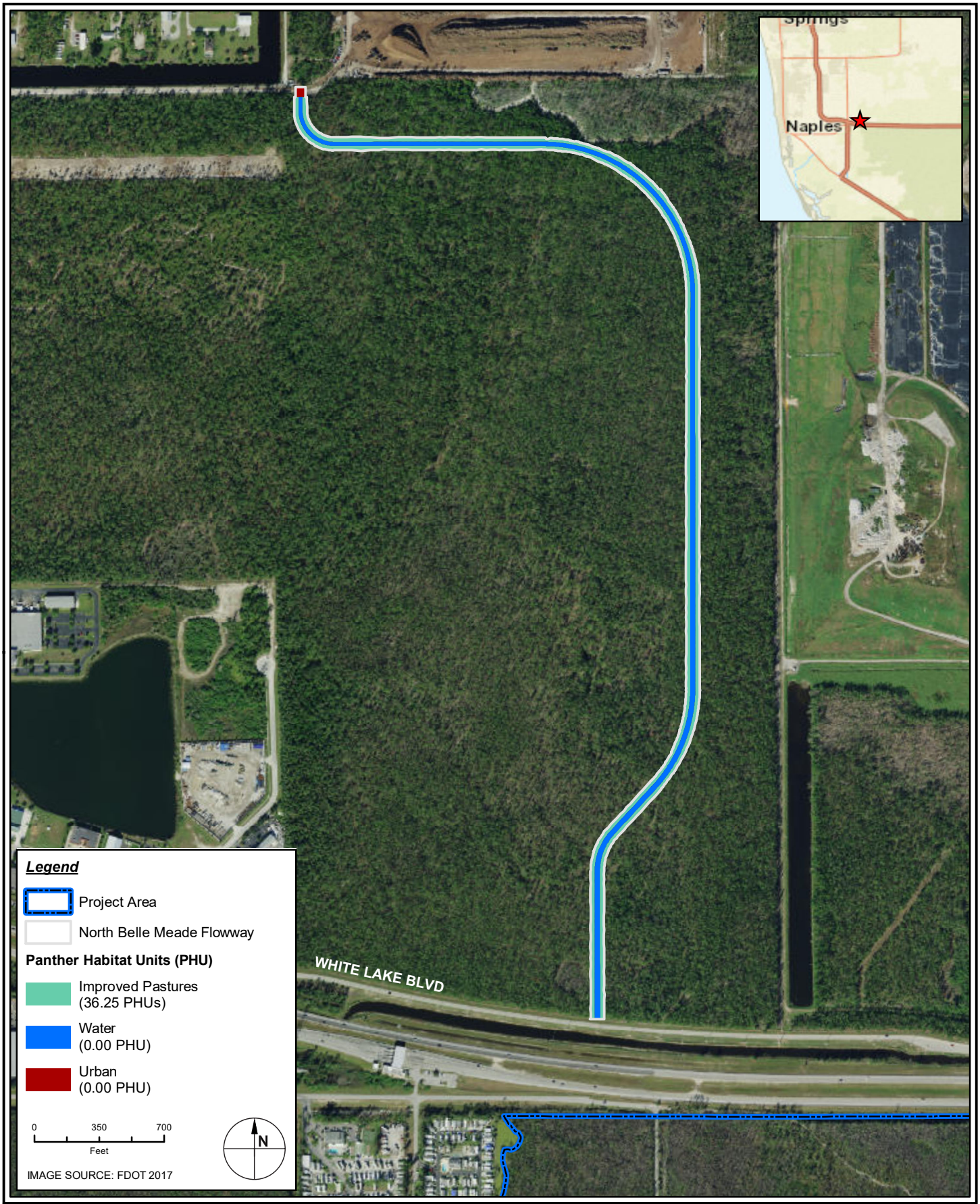

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FIGURE 2
NORTH BELLE MEADE FLOWWAY
PROPOSED PANTHER HABITAT UNITS
PANTHER ANALYSIS
COLLIER COUNTY, FLORIDA

PROJECT	C2018-052
DRAWN BY	KM
SHEET	
DATE	FEB 2020

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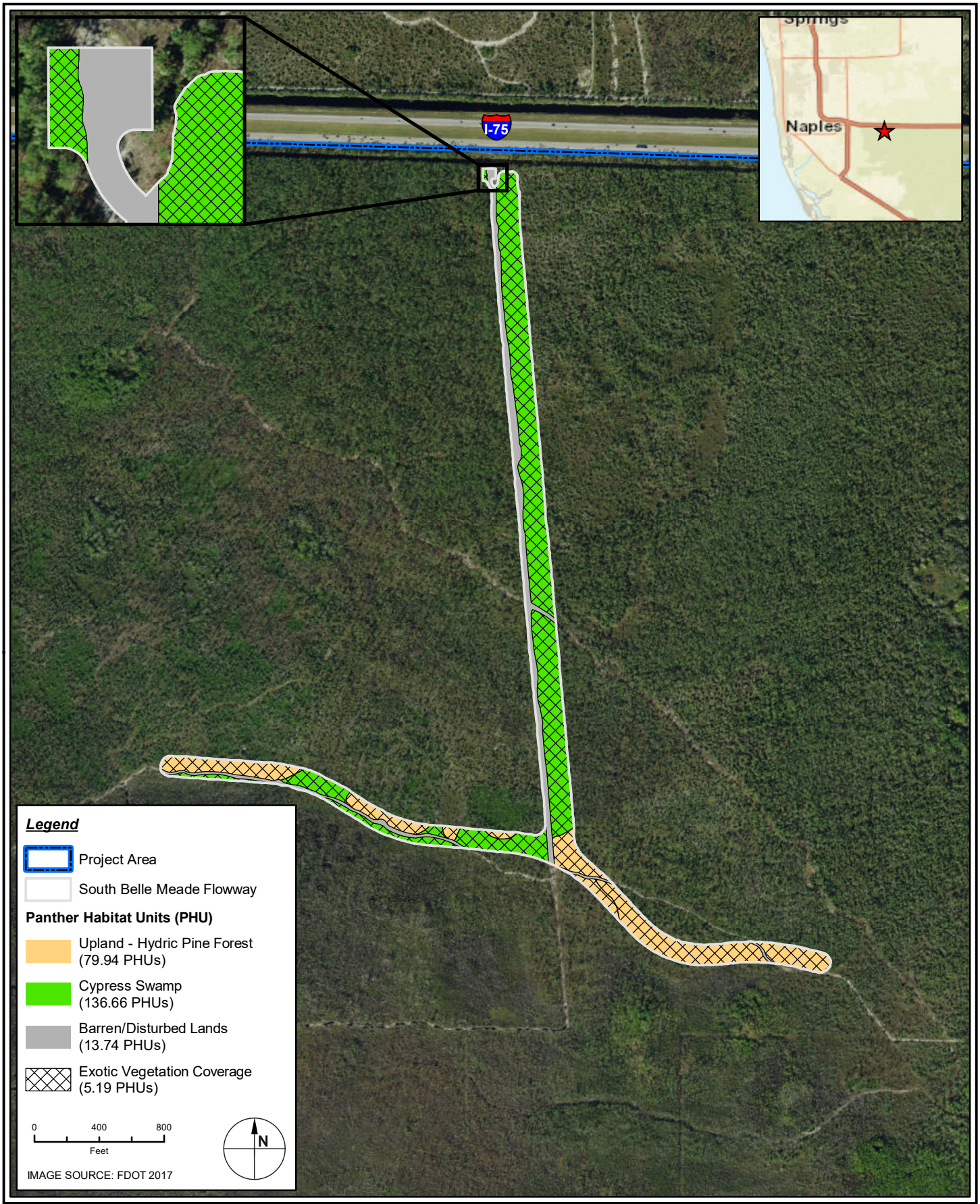

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FIGURE 3
SOUTH BELLE MEADE FLOWWAY
EXISTING PANTHER HABITAT UNITS
PANTHER ANALYSIS
COLLIER COUNTY, FLORIDA

PROJECT	C2018-052
DRAWN BY	KM
SHEET	
DATE	JAN 2020

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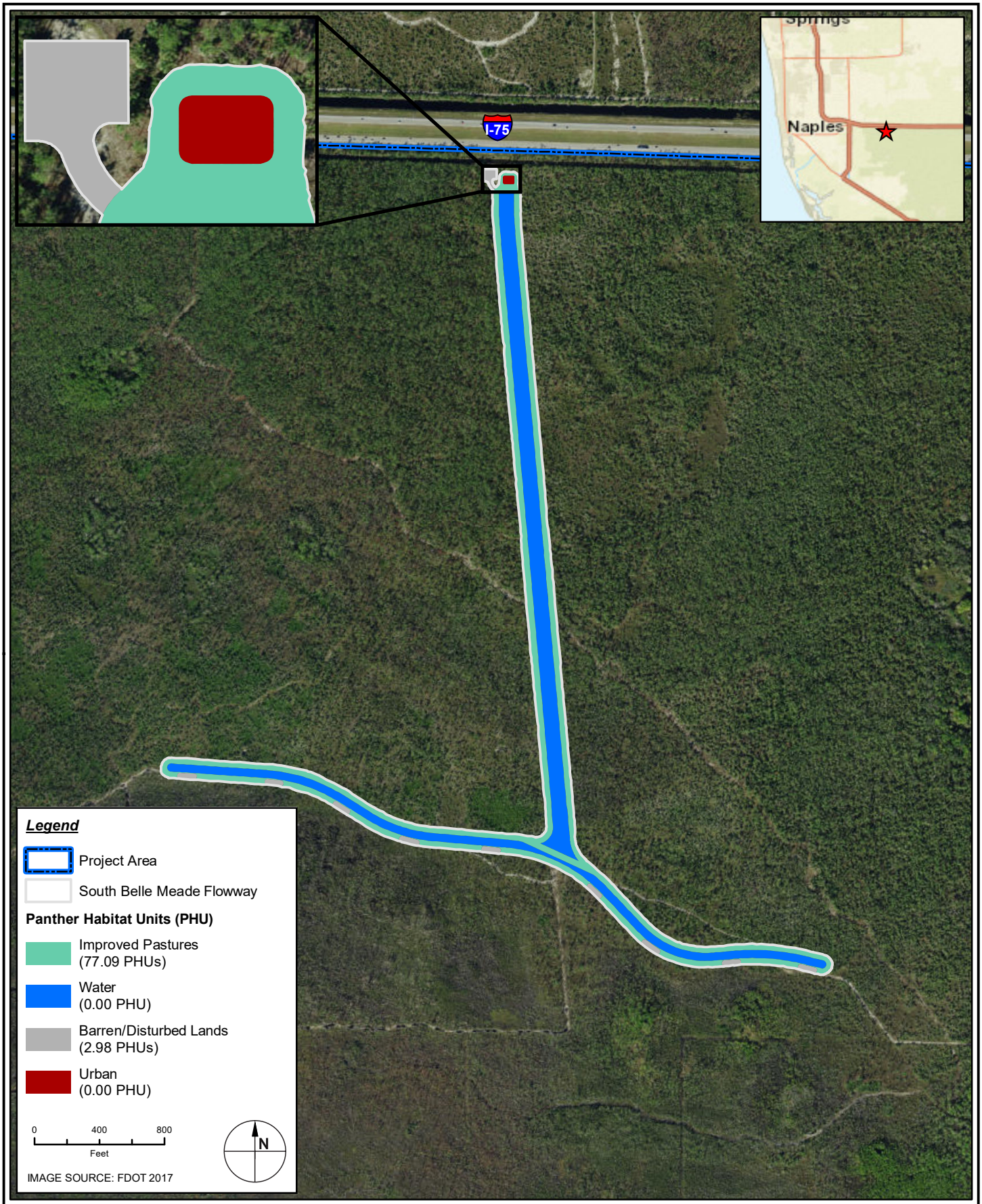

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FIGURE 4
SOUTH BELLE MEADE FLOWWAY
PROPOSED PANTHER HABITAT UNITS
PANTHER ANALYSIS
COLLIER COUNTY, FLORIDA

PROJECT	C2018-052
DRAWN BY	KM
SHEET	
DATE	JAN 2020

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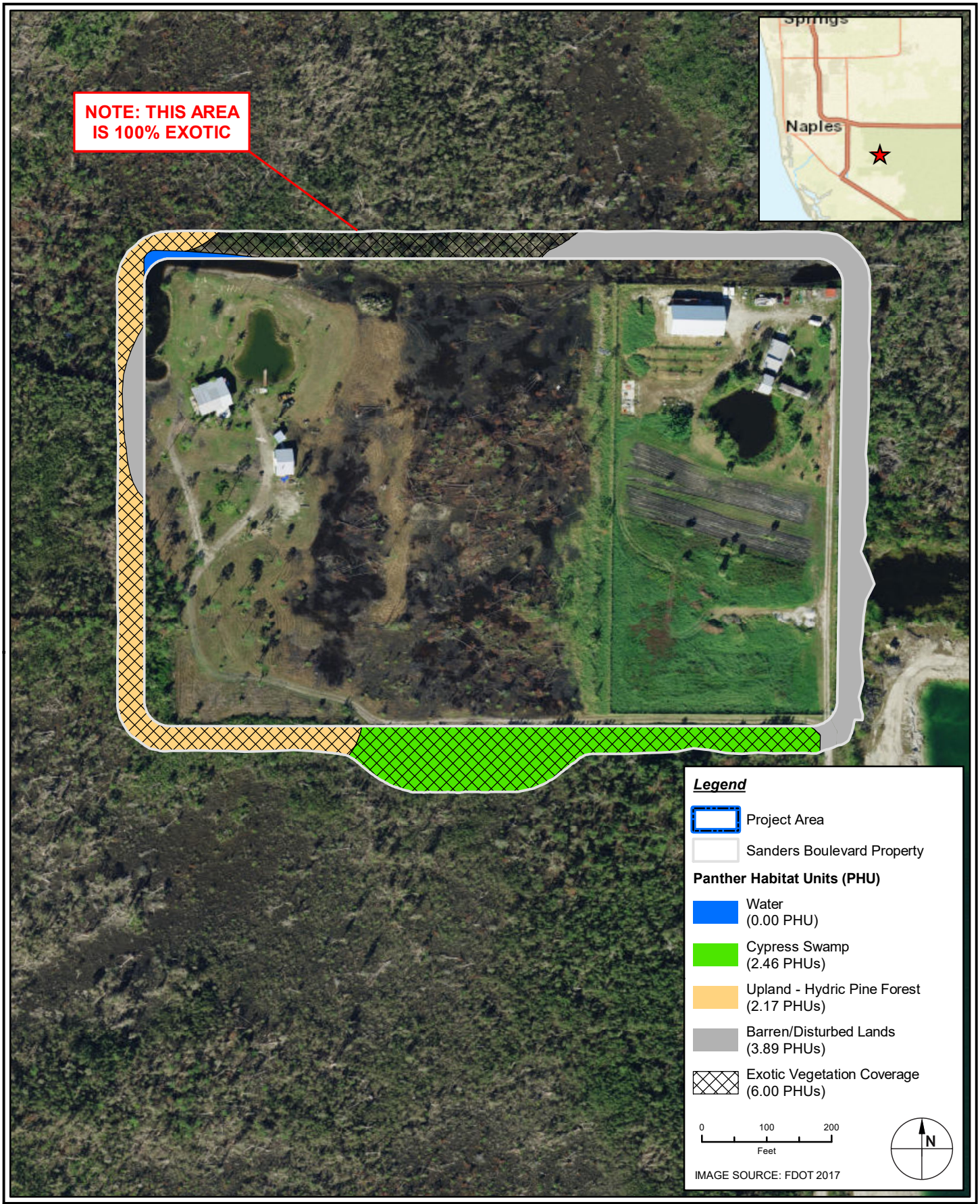

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FIGURE 5
SANDERS BOULEVARD PROPERTY
EXISTING PANTHER HABITAT UNITS
PANTHER ANALYSIS
COLLIER COUNTY, FLORIDA

PROJECT	C2018-052
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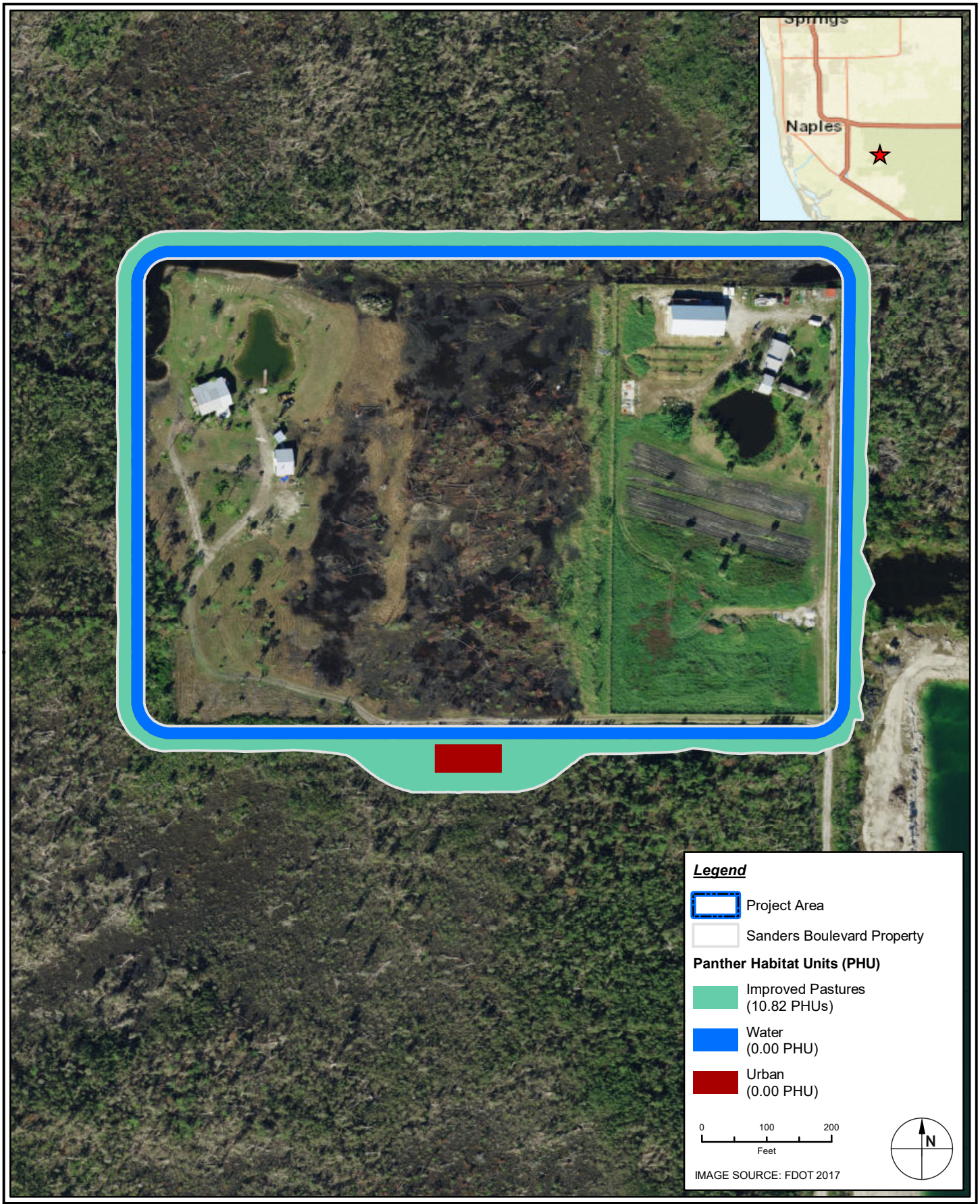

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FIGURE 6
SANDERS BOULEVARD PROPERTY
PROPOSED PANTHER HABITAT UNITS
PANTHER ANALYSIS
COLLIER COUNTY, FLORIDA

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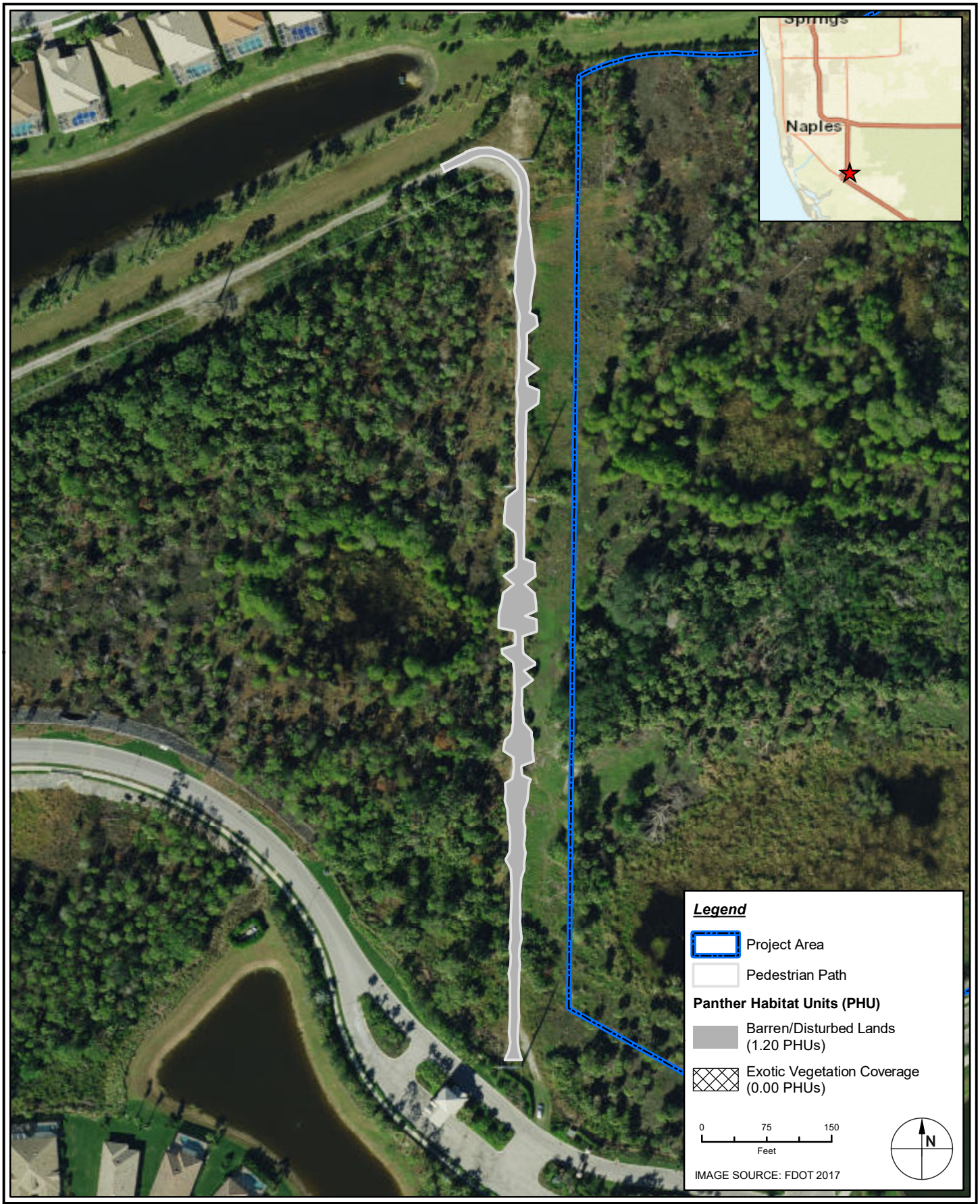

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FIGURE 7
PEDESTRIAN PATH
EXISTING PANTHER HABITAT UNITS
PANTHER ANALYSIS
COLLIER COUNTY, FLORIDA

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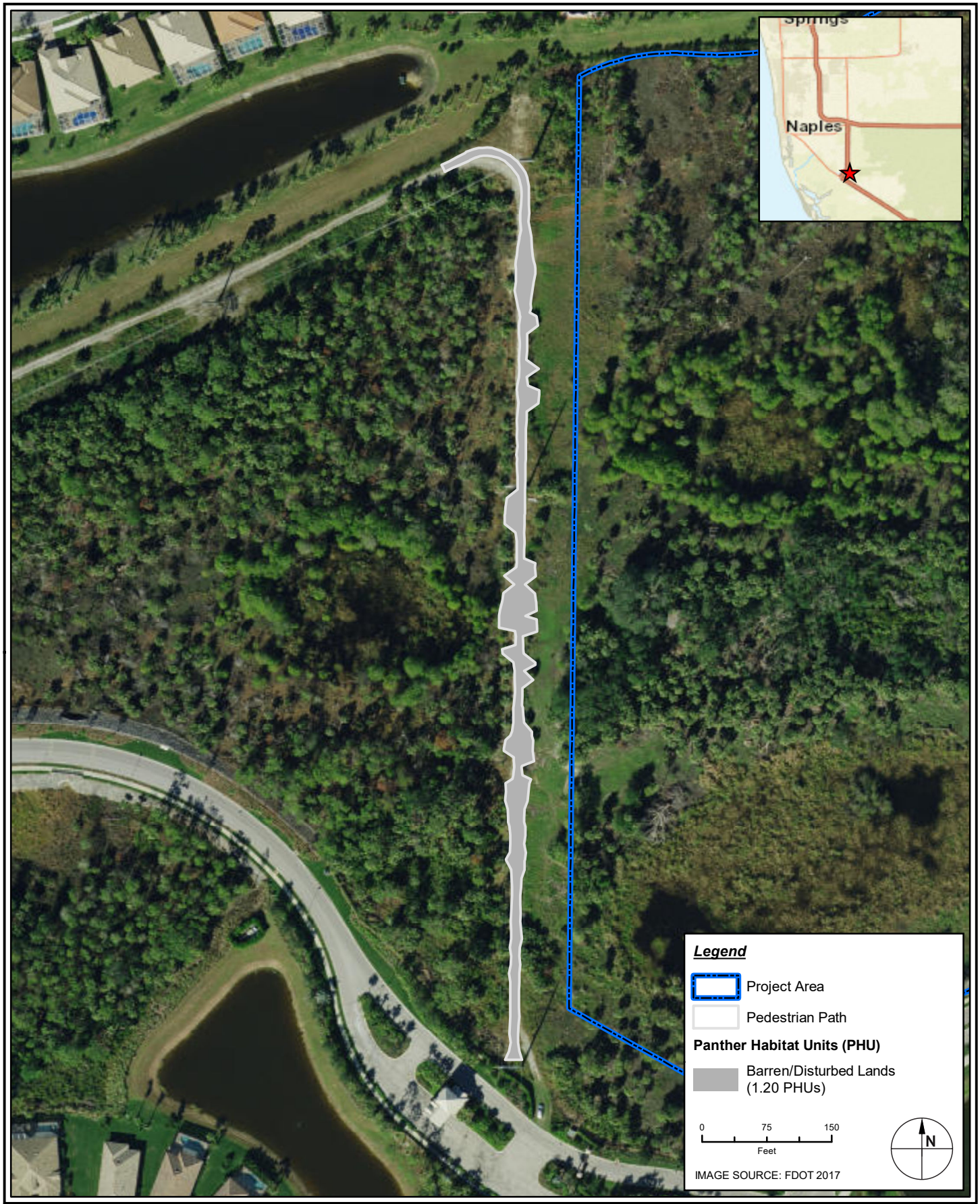

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FIGURE 8
PEDESTRIAN PATH
PROPOSED PANTHER HABITAT UNITS
PANTHER ANALYSIS
COLLIER COUNTY, FLORIDA

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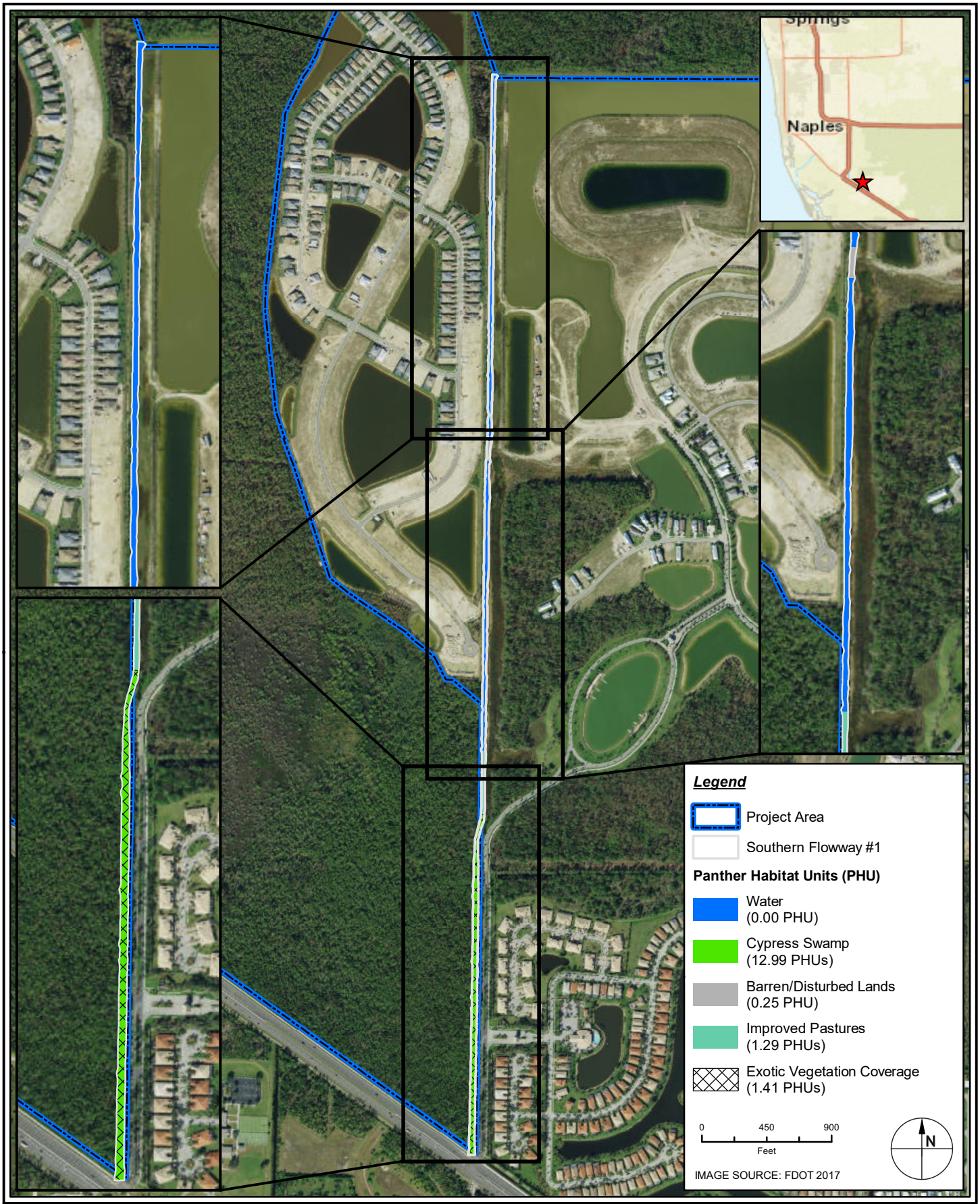

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FIGURE 9
SOUTHERN FLOWWAY #1
EXISTING PANTHER HABITAT UNITS
PANTHER ANALYSIS
COLLIER COUNTY, FLORIDA

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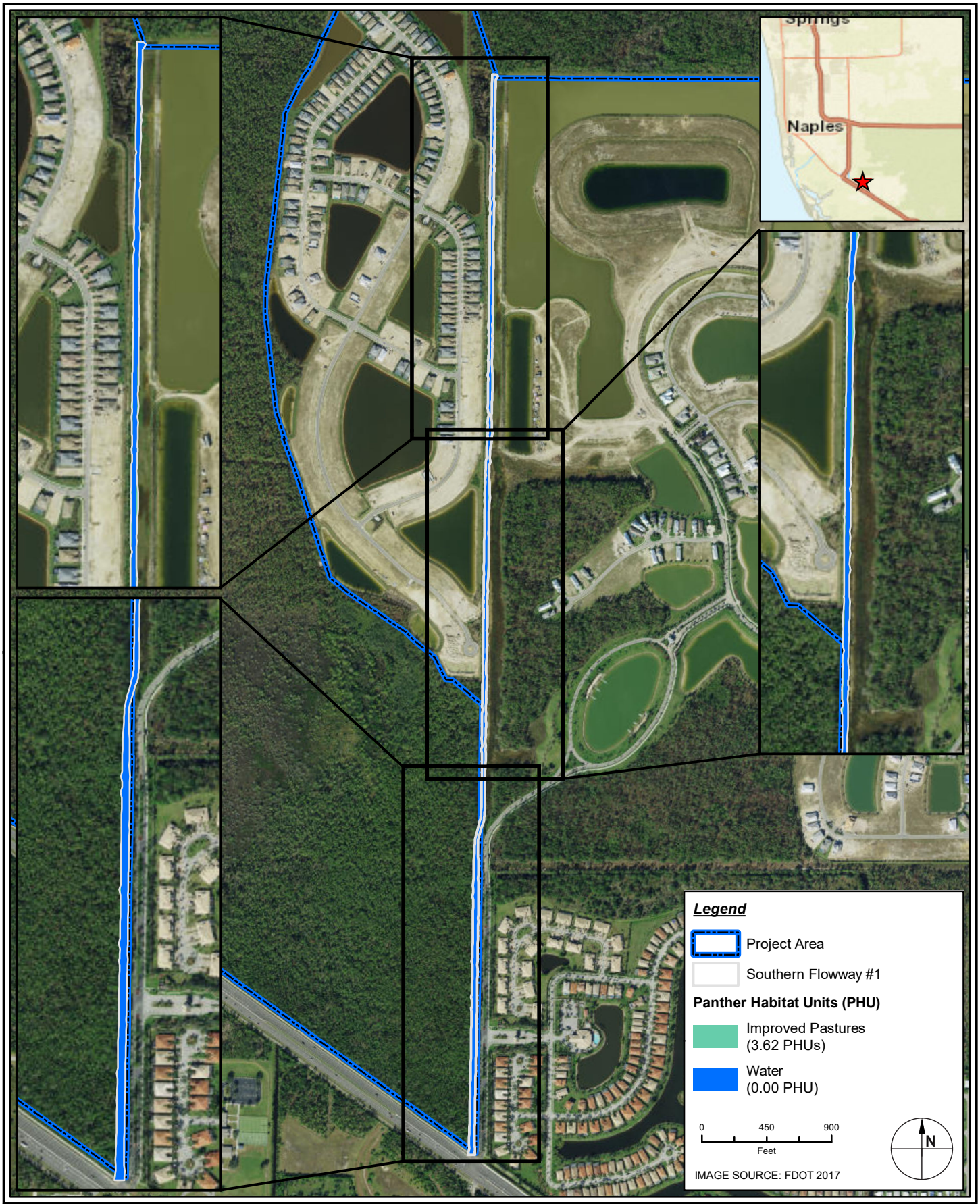

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FIGURE 10
SOUTHERN FLOWWAY #1
PROPOSED PANTHER HABITAT UNITS
PANTHER ANALYSIS
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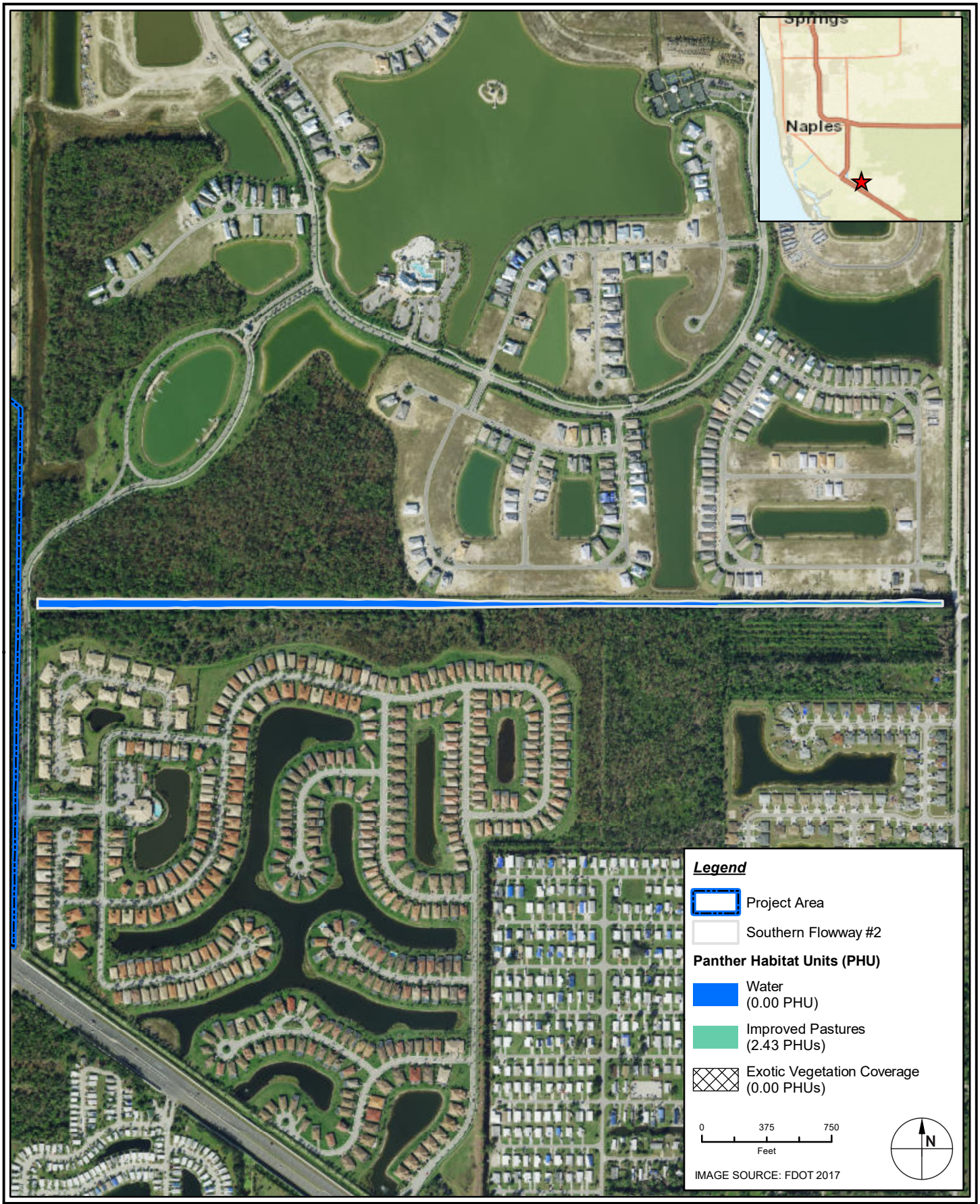

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FIGURE 11
SOUTHERN FLOWWAY #2
EXISTING PANTHER HABITAT UNITS
PANTHER ANALYSIS
COLLIER COUNTY, FLORIDA

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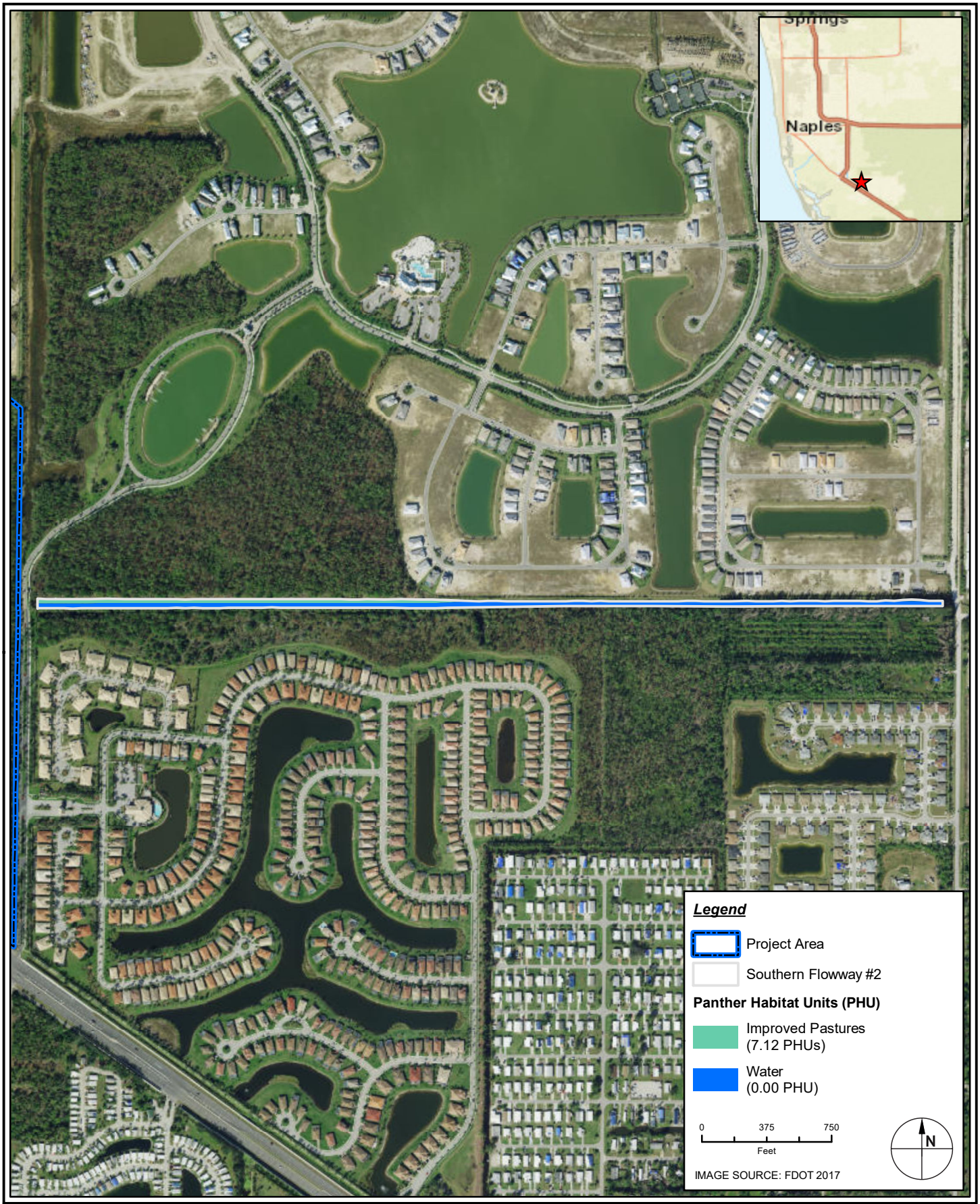

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FIGURE 12
SOUTHERN FLOWWAY #2
PROPOSED PANTHER HABITAT UNITS
PANTHER ANALYSIS
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FIGURE 13
SOUTHERN FLOWWAY #3
EXISTING PANTHER HABITAT UNITS
PANTHER ANALYSIS
COLLIER COUNTY, FLORIDA

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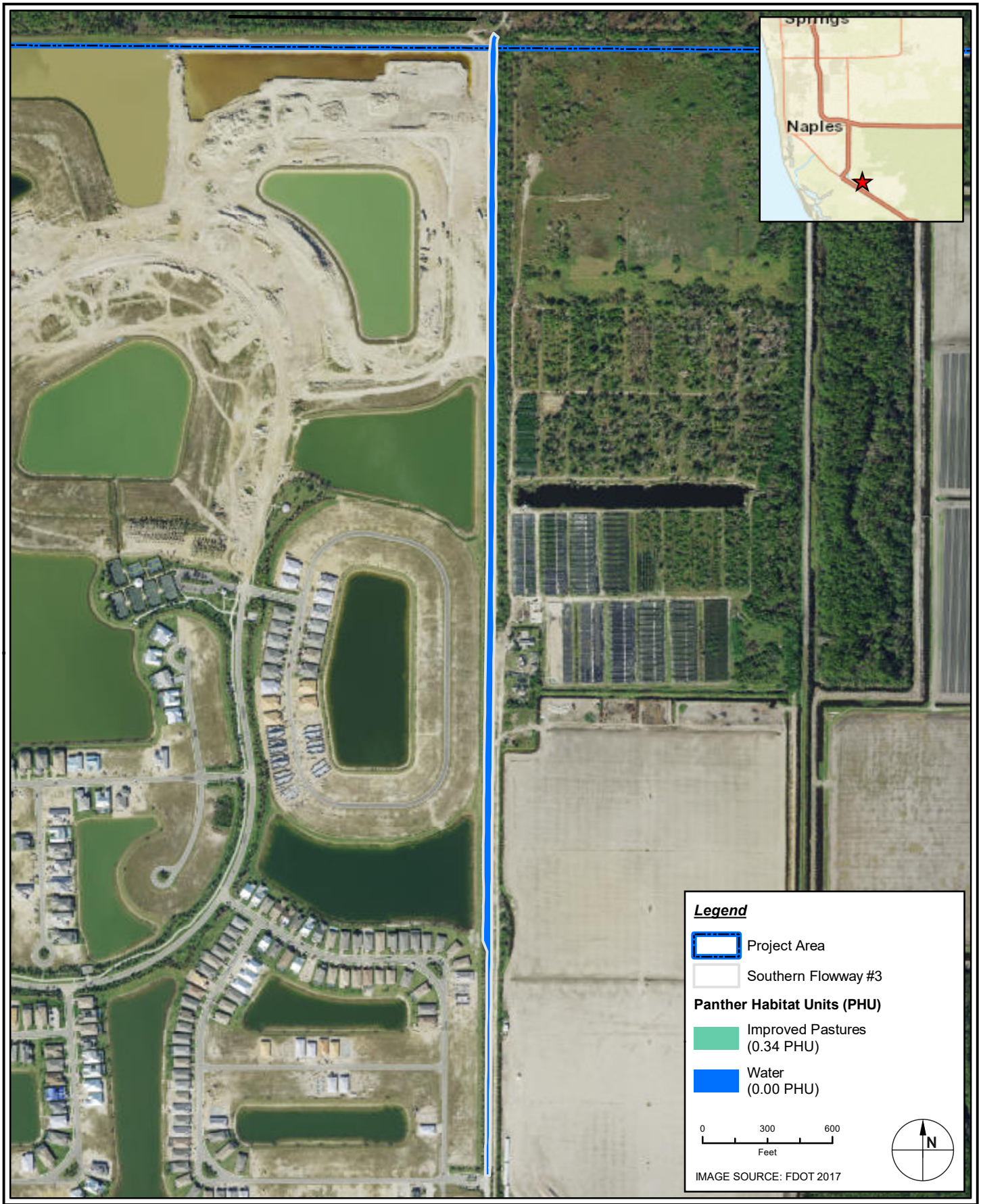

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FIGURE 14
SOUTHERN FLOWWAY #3
PROPOSED PANTHER HABITAT UNITS
PANTHER ANALYSIS
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FIGURE 15
SOUTHERN FLOWWAY #4
EXISTING PANTHER HABITAT UNITS
PANTHER ANALYSIS
COLLIER COUNTY, FLORIDA

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FIGURE 16
SOUTHERN FLOWWAY #4
PROPOSED PANTHER HABITAT UNITS
PANTHER ANALYSIS
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